



Dr. Jekyll vis-à-vis Mr. Hyde: Personality variation between virtual and real worlds

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ARTICLE INFO

Article history:

Received 6 February 2009

Received in revised form 24 June 2009

Accepted 25 December 2009

Available online 17 December 2010

Keywords:

Virtual-world

Personality

Personality variations

Technology-mediated group discussion

Self-regulation theory

ABSTRACT

Organizations use virtual-worlds to enhance group discussion; it allows an individual to decouple his or her rendered from actual behavior; resulting in others perceiving him or her to have two or more personalities. Building on self-regulation theory, we examined how satisfaction in the virtual-world was affected by these personality differences. A field study was conducted to attempt to understand this; it involved 297 students engaged in a virtual tutorial group using Second Life. We found that small variations in personality between the virtual and real world groups (such as being helpful, sociable, seeking recognition, or submissive) could lead to greater satisfaction of the discussion.

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1. Introduction

The use of technology to facilitate group interactions is an important issue today. The recent addition of virtual worlds, such as Second Life (<http://secondlife.com/>), provides new opportunities for organizations to facilitate group interaction [3,15], especially when members are geographically distributed [2,21]. Corporations such as IBM and Sun, and educational institutions such as Harvard and Princeton, have begun to explore the use of virtual-worlds for group collaboration and learning purposes. However, there has been little research on how organizations could benefit by doing so. Among others, a question that has captured researchers' attention is whether one would exhibit a different personality in the virtual- versus the real-world, and whether such a difference could affect an individual's satisfaction resulting from participating in such an environment [12].

Satisfaction determines an individual's intention to continue using a technology. This variable is important for organizations that decided to employ a virtual-world technology, which, in Second Life requires purchasing a piece of "dedicated land" for \$1000 and paying a monthly maintenance fee of \$295; the organization must also "build" 3D facilities. Failure to acquire participants' satisfaction while using this environment may make them reluctant to use it. In our study, we considered personality

factors and deviations between the real- and virtual-world as important determinants of individual satisfaction.

Personality accounts for consistent patterns of thinking, behavior, and feeling [7]. Allowing a person to experience "being someone else" and reducing social and physical barriers to communication, a virtual environment can change the individual's exhibited personality [24]. This may, in turn, affect the individual's communication experience, with satisfaction being one of its results [17], as personality influences one's interaction with others. It has been postulated that a virtual environment could encourage disinhibition (a person's reacting according to feelings due to a perception of less restraint on his or her action) [23]. The resultant changed personalities may therefore influence an individual's satisfaction in interacting with others. This leads to our research question:

What is the impact of a deviation in personality between the virtual- and real-world on an individual's interaction satisfaction in a technology-mediated group discussion?

To the best of our knowledge, there has been no research that has dealt directly with the effects of personality differences on interaction experience and satisfaction due to interacting with others in a virtual-world. With few exceptions (e.g., [22]), prior work on the virtual-world has been restricted to the virtual realm without comparing personalities and behavior in the virtual- and real-world. Without such comparison and understanding, it is not clear how a perceived personality difference would affect the quality of the interaction. Thus, we sought to examine the correlation between a

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Table 1
Recent personality studies.

Reference	Research objective	Type of study	Key findings
[20]	To examine the affective, behavioral, and cognitive nature of Big-Five factors	Surveys (n = 3, 6, 27)	Extraversion reflects affective and behavioral natures, agreeableness and conscientiousness are more behavioral in nature, neuroticism is affective in nature, and openness is cognitive in nature
[8]	To develop brief measures of the Big-Five factors	Surveys (n = 1704, 118, 63, 83, 1813, 180)	Proposed a 10-item measure of the Big-Five dimensions for situations where very short measures are needed, personality is not the primary topic of interest, or researchers can tolerate the diminished psychometric properties associated with very brief measures

person's personality difference in the two worlds and the satisfaction derived from the interaction experience.

There are two important distinctions between the focus of prior research and ours. First, many of the prior studies examined the issue of interaction among people in an *uncontrolled virtual setting* where there was no well-defined objective [14,25], such as social dealings in which people communicated with anyone they “met”. For instance, McKenna et al. observed that individuals who feel that they can better disclose their inner-self to others on the Internet would be more likely to build close relationships online. In our study, we therefore investigated personality differences in the less explored context of technology-mediated group discussion where there is a clearly defined objective for interaction, e.g., problem-solving, decision-making, and collaborative learning [1,9].

Second, many other studies have focused on social interaction and discussion among individuals who are *not aware of each other's identities*. However, in an organizational setting, individuals are likely to know or be able to *identify the people* with whom they interact in a group. This may restrain the degree of difference in personality seen in the virtual-world. Essentially, we argued that people who perceived fewer personality differences would derive greater satisfaction from engaging in group discussion.

Through the lens of the self-regulation theory, our study provides a fresh perspective on the issue of people-to-people interaction in a virtual-world environment enabling technology-mediated group discussion.

Our study used a two-pronged empirical approach to examine how variations in personality could affect *the derivation of satisfaction from engaging in virtual-world group discussion*. We began by first identifying the personality factors needed to assess the changes by reviewing seminal personality literature and then using experts in a focus-group discussion to filter the extensive list of personality factors derived to determine a pertinent set of factors for our study. Next, we built on self-regulation theory to posit that an individual perceiving fewer variations in personality in the virtual-world (as opposed to the real-world) would enjoy a more positive experience. A field experiment in a newly constructed virtual environment in Second Life was then conducted to test our hypotheses.

2. Conceptual background

Second Life offers a three-dimensional environment for interaction. It allows the user to construct three-dimensional visualizations that simulate real-world settings; offering a synthetic, immersive discussion experience. Within this simulated environment, individuals engage in problem-solving in much the same way as in the real-world; they interact via their avatars in the virtual-world. They can sit on chairs in the virtual room and observe the surrounding environment. Such a three-dimensional setting permits individuals to be aware of the presence and proximity of their peers. Thus individuals receive constant stimuli that reinforce and remind them of the goal of the activity: to discuss a set of problems or issues with group members.

2.1. Relevant personality literature

Here we highlight some of the recent personality models that are relevant to our study (see Table 1). Though Raymond Cattell introduced a relatively complex taxonomy of 16 personality factors, attempts by other researchers to replicate his work were unsuccessful and, in each case, they found not more than six factors that matched/supported the data. This stream of research has resulted in two broad initiatives characterizing the recent decade of personality research.

The first built on the supposition that prior models might not offer adequate measurement of personality traits. This led in turn to the creation of the “Big-Five” model, a hierarchical model of five broad dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness. Building on these five dimensions, advocates proposed a large number of distinct and specific personality factors. This resulted in the creation of an extended list of personality questions, but while these instruments had good psychometric properties, they were cognitively taxing and time-consuming to complete.

The second initiative, which sought to address the challenges of the first, focused on trading off psychometric properties for the ease in administering a research instrument. It refined the older models to propose a smaller set of personality factors, which could still explain a reasonable amount of behavioral variance. However, the sets of items derived were based on statistical means and suffered from a lack of theoretical justification. In attempting to reconcile the two initiatives, we argued that the personality factors may differ, depending on the context. In particular, an exhaustive set of personality factors can be used for general purpose assessment, such as for evaluating the aptitude of an employee but that when personality factors were used to reflect and contrast behaviors across two or more situations (such as virtual *versus* real world group discussions), a more tailored set of personality factors would be needed.

The literature on human behavior in the virtual-world, while recognizing an individual's tendency to exhibit a different personality in a virtual environment, does not systematically identify a set of pertinent personality factors for investigating personality differences. Ref. [24] discussed virtual personalities in terms of their legal implications. Ref. [25] offered an understanding of how individuals adopt the virtual-world to build their virtual personalities. Common to these studies was a lack of systematic explication of the kinds of personalities that are relevant. Thus, we attempted to identify the personality factors that may be employed to reflect and contrast behaviors between the worlds.

2.2. Identification of pertinent personality factors

We first derived a set of personality factors that could be affected by the virtual-world setting. We then employed focus groups consisting of five individuals to produce a subset of these factors in which the differences between the real and virtual worlds are likely to be valid. These individuals were chosen because they had used Second Life for at least 6 months and had

more than 4 years' experience in behavioral research. Due to these stringent criteria, we only managed to find five participants and the entire focus group discussion lasted 3 h. The first author led the discussion, while the other authors took notes of the discussion; these notes were compiled for further analysis.

The focus group participants were first shown short clips of virtual-world group discussions and then given copies of personality factors compiled from prior research papers; they were then asked to select personality factors based on their initial impressions, and told that the factors should show the differences between real and virtual worlds; and bear relevance to the context of the group discussion setting. The participants were also asked to describe their expected differences between the “two worlds” for the personality factors they had selected. Next, we conducted a round of deliberation during which each of the personality factors was discussed. The participants were encouraged to share their opinions openly and discuss the similarities and differences among the factors, and why certain personality factors were relevant or irrelevant, with respect to their expected differences in the “two worlds”. Ultimately, the participants were asked to list the set of personality factors that they considered to be indispensable to the context of our study.

Three personality factors were unanimously specified as important by the participants: sociability, submissiveness, and seeking recognition. The participants agreed that people tend to act differently in the real and virtual worlds in how sociable they are. One participant also commented: “*It is easy to observe that some people tend to be more aggressive and dominant in expressing their views in virtual group discussions, while in real life, they display a submissive personality.*” Another noted that it was important for a person to receive recognition of their participation from their peers.

Helpfulness (willingness to help peers), honesty, composure, and creativity were also listed as *essential* qualities by four participants. A participant remarked that people might be more open to voicing their true opinions in virtual environments due to a lack of face-to-face cues. Participants also agreed that people in virtual environments might tend to adopt unstable temperaments, becoming more easily agitated or annoyed.

Sensitiveness and being organized were considered important by three participants, but the two others felt that it might be difficult for individuals to project themselves as either sensitive/organized or insensitive/disorganized in the virtual environments.

Following the focus group discussion, we made two additional attempts to validate the appropriateness and relevance of the factors. First, we consulted two senior professors to assess the personality factors; they agreed with the results from the focus group: the seven personality factors (sociability, submissiveness, seeking of recognition, helpfulness, honesty, composure, and creativity) were essential in our context, while sensitivity and being organized were less relevant. Second, we mapped the seven factors to personality literature, and discovered that they were in accordance with the mainstream of the literature (see [20]). Specifically, the seven personality factors can be mapped onto prior literature in the following ways: (1) *sociability* and *seeking of recognition* denote personalities of the affective and behavioral natures; (2) *submissiveness* and *helpfulness* signify a personality of a behavioral nature; (3) *honesty* denotes a personality of a behavioral nature; (4) *composure* reflects neuroticism, denoting a personality of an affective nature; and (5) *creativity*, reflecting openness, denotes a personality of a cognitive nature.

Thus, the seven specific personality factors included in our study were *creativity* (production of novel processes or procedures), *helpfulness* (volunteerism out of kindness), *sociability* (intimate association with others), *honesty* (refusal to pretend that facts are other than what they are), *seeking of recognition* (desire for public appreciation), *composure* (remaining calm in

most situations), and *submissiveness* (tendency to back down in conflict).

2.3. Hypothesis development

A person who “disinhibits” in a virtual world engages in behavior that is less constrained than comparative behavior in real life, such as a reduction in concern about other people's perceptions and judgments [6,23]. Reasons have been suggested for this tendency; including the anonymity and invisibility available in a virtual world [23].

Several researchers advocate that such a disinhibition tendency in virtual environments could be beneficial to discussions, e.g., Dietz-Uhler and Bishop-Clark [5] contend that individuals participating in virtual discussions feel less constrained in expressing their ideas and opinions; however, their overarching assumption was that individuals in virtual environments are less concerned about others' perceptions because of anonymity. This may not be true if individuals are known through face-to-face contact, as is typical in a real-life situation. Our research assumed that individuals strive to regulate themselves to fit the overall goal of participating in a group discussion setting and may try to minimize disinhibition and assume personalities closer to those that they would assume in a physical setting with only a slight variation in their real- versus virtual-world personality.

Our focus here was on how individuals regulate their perceived personalities between real and virtual worlds and how this may impact their satisfaction with their interaction. Self-regulation theory posits that people exercise self-control to orient themselves towards certain goals or objectives appropriate to a particular situation [10].

Self-regulation involves the processes, internal and/or transactional, that allow an individual to determine his or her goal-directed activities. Such regulative processes may entail the modulation of thought, affect, or behavior via deliberate or automatic use of specific mechanisms and supportive skills to fit certain social and behavioral standards. Thus if a person's behavior is deemed consistent with the expected standards the person will experience satisfaction with the interaction. This leads to the hypothesis that:

The smaller the variation in an individual's personality in the real vis-à-vis virtual world, the greater the satisfaction derived from participating in a virtual group discussion.

Specifically, smaller variations in personality between the virtual and real worlds into creativity (*H1*), helpfulness (*H2*), sociability (*H3*), honesty (*H4*), seeking of recognition (*H5*), composure (*H6*), and submissiveness (*H7*) lead to greater satisfaction in virtual group discussion.

3. Research methodology

A survey was employed in this study. The construction of our instrument was based on established measures from prior literature with slight adaptations (see Table 2). All items were measured using a 1–7 Likert scale (spanning from strongly disagree to strongly agree). Face validity and content validity of all items were assessed in three ways. First, the items were examined by three senior scholars cognizant in personality literature; they identified problems in the framing and phrasing of questions. Second, all items were tested for conceptual validity by conducting unlabeled and labeled sorting sessions with four judges for each item. Third, a pilot test of the questions was administered on six IS graduate students. Minor modifications were then made to the questionnaire.

Table 2
Operationalization of variables.

Variable	Item	Description
Personality variables (starting words of questions: I consider myself a person who... ^a)		
Creativeness (CRET)	CRET01	Likes to experiment with new ways of doing things
	CRET02	Likes to try new things
	CRET03	Likes to try different things
Helpfulness (HELP) [14,18]	HELP01	Always tries to help others to achieve their goals
	HELP02	Always pays attention to the needs of other people
	HELP03	Cares about others' welfare very much
Sociability (SOCB) [18]	SOCB01	Is sociable
	SOCB02	Is able to get along with all kinds of people
	SOCB03	Is skilful in developing social relationships with others
Honesty (HONS) [18]	HONS01	Always tells the truth even though it may hurt others
	HONS02	Speaks my mind truthfully, without regard for the consequences
	HONS03	Does not tell lies on all kinds of occasions
Seeking of recognition (RECO) [18]	RECO01	Likes to be recognized by others
	RECO02	Likes to be respected by others
	RECO03	Likes to gain reputation among my peers
Composure (COMP)	COMP01	Never loses my temper, no matter what the reason
	COMP02	Seldom lets go of my temper
	COMP03	Always remains calm even in bad situations
Submissiveness (SUBM)	SUBM01	Always gives in when arguing with others
	SUBM02	Seldom insists on sticking by my arguments
Dependent variable		
Satisfaction (SATF) [11]	SATF01	I really like participating in the Second Life
	SATF02	Participating in the Second Life is enjoyable
	SATF03	Participating in the Second Life is pleasurable
	SATF04	My experiences in Second Life have generally been positive
	SATF05	Overall, I am pleased to interact with other people in the Second Life

^a In the second survey, we asked respondents to provide their responses to the items with respect to Second Life.

Our study was conducted in non-anonymous, task-oriented virtual tutorial group discussions of 17–22 undergraduate students who had completed an introductory computing course in a public university in Asia. Participation was voluntary but extra course credit was awarded.

The discussion sessions were carefully designed to mirror group discussions conducted in an organizational setting in three ways: (1) goal-directed discussions, in which participants were engaged to solve a set of problems (finding solutions to a series of computing-related problems); (2) lack of anonymity (participants knew the other participants); and (3) participants could freely express their opinions on how the problems could be solved, with facilitators (instructors) aiding the discussion.

Two surveys were administered sequentially to the students. Fig. 2 depicts the timeline of the administration of the two surveys. The first, which focused on assessing the participants' perceived personality, was administered prior to the virtual tutorial group discussion and after three consecutive traditional (face-to-face) tutorial group discussions. For each tutorial, the students were

given different sets of questions to be discussed. This was to make sure that participants were accustomed to interacting with their classmates. One week after the first survey, they attended lectures and participated in hands-on exercises on: (1) installation and familiarization with the Second Life environment; (2) basic navigation skills, e.g., walking, flying, and teleporting; (3) communication means (text and voice modes); and (4) performing gestures through their avatars, e.g., clapping hands. It was imperative to note that the university had procured several islands in Second Life and constructed virtual replicas of several university landmarks on them. The virtual tutorial room was one of the many facilities provided for this virtual university campus (see Fig. 1).

The virtual tutorial room was equipped with tables, chairs, a whiteboard and a slide projector, thus resembling a physical tutorial room setting. To minimize disruption, the virtual tutorial room was protected with security measures that limited access to only authorized students. After the lectures and hands-on exercises on the use of Second Life, each student attended the virtual tutorial room discussions in three consecutive weeks by



Virtual room setting



Subjects engaging in virtual group discussion

Fig. 1. Setting for virtual group discussion.

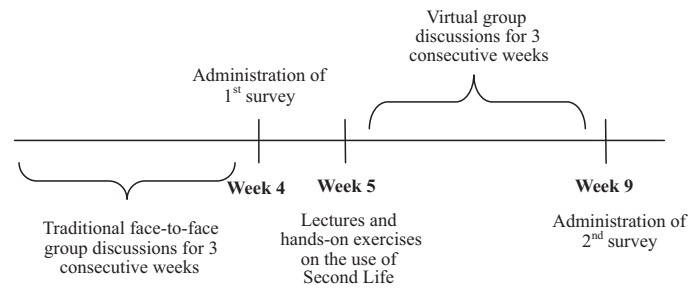


Fig. 2. Administration of the field study.

logging-in from any convenient locations (e.g., room, cafe, garden, etc.). After the last virtual group discussions, the participants completed the second survey (Fig. 2).

Of 450 participants, 326 filled in both the surveys for our study; after removing 29 due to missing data, we had 297 (66%) usable completed responses (see Table 3). To test for possible non-response bias, we compared the means of all variables and demographics for early and late respondents. The results of the *t*-tests indicated that none of the variables was significantly different. Thus, non-response bias was not evident in our sample.

4. Results

Prior to our data analysis, we examined both convergent and discriminant validity through factor analysis. The results of our tests are shown in Table 4. The first survey focused on assessing

Table 3
Profile of Participants.

Demographic/control variables	Frequency (<i>n</i> = 297)	Percentage (%)
Faculty		
Science	89	30.0
Business	55	18.5
Arts and Social Sciences	142	47.8
Engineering	11	3.7
Years of study		
1	102	34.3
2	89	30.0
3	84	28.3
4 and above	22	7.4
Gender		
Male	94	31.6
Female	203	68.4
Ethnic origin		
Chinese	260	87.5
Malay	14	4.7
Indian	17	5.7
Others	6	2.0
Age		
20 and below	74	24.9
21	78	26.3
22	73	24.6
23	41	13.8
24	20	6.7
25 and above	11	3.7
Years of computer experience (YCOM)		
Less than 5 years	9	3.0
6–10 years	176	59.3
11–15 years	109	36.7
16 years and above	3	1.0
Years of Internet experience (YINT)		
Less than 5 years	28	9.4
6–10 years	226	76.1
11 years and above	43	14.5

each individual's normal personality and was conducted before the start of the Second Life virtual group discussion. The second survey focused on eliciting how individuals perceived their virtual-world personality and was conducted immediately after the virtual group discussion. Given the temporal difference in administering the surveys, two separate factor analyses were conducted. The results from these two revealed that discriminant validity was satisfied (i.e., factor loadings of all items on their intended construct were above the minimum recommended level of 0.5 and no cross-loading was detected). Additionally, Table 5 shows that the correlations among constructs, diagonal elements (values of the square root of AVE for each construct) exceeded other entries in the same row or column, which provided support for the discriminant validity of the constructs. Next we computed the Cronbach's alpha values for each variable to test for reliability. Values were computed for both pre and post group work; they ranged from 0.74 to 0.97 (well above the normal 0.7 threshold); thus the variables were deemed to have adequate reliability.

4.1. Computation of the variant in personality scale

To test our hypotheses, we needed to first compute the relevant variation of values. In accordance with prior studies of personality variation [16], we defined the variation for personality *i* as $X_i = (\alpha_i - \beta_i)^2$, where α_i denoted the rated personality *i* score for the real-world and β_i refers to the rated personality *i* score for the virtual-world.

With the computed variation values, we examined the normality of the variables, testing for it using both its Skewness and its Kurtosis. Our tests suggested that variations in the personality factors "creativity" (Skewness *Z* = 4.5; Kurtosis *Z* = 7.0), "helpfulness" (Skewness *Z* = 3.3; Kurtosis *Z* = 15), "sociability" (Skewness *Z* = 5.59; Kurtosis *Z* = 41.), "honesty" (Skewness *Z* = 5; Kurtosis *Z* = 41), "seeking of recognition" (Skewness *Z* = 3.1; Kurtosis *Z* = 12), "composure" (Skewness *Z* = 3.76; Kurtosis *Z* = 23), and "submissiveness" (Skewness *Z* = 3; Kurtosis *Z* = 11) showed high Skewness and Kurtosis. The positive Skewness of these variables suggested that relatively more respondents experienced greater than median variation in perceived personalities between the virtual and real worlds. This seems to support previous results that highlighted the greater propensity for individuals to exhibit differences in personality when they are in the virtual-world. Nonetheless, log-transformation was performed on these variables since they could affect the robustness of the results if not addressed. After the transformation, the variables satisfied the normality test. Following the transformation of the variables, we conducted the test for multicollinearity by computing the variance inflation factor (VIF) for each independent variable (i.e., the personality factors). As depicted in Table 6, all these values were well below 10, ranging from 1.1 to 1.4. Hence, multicollinearity was not present.

Table 4
Factor analysis.

Item	Survey 1 (before virtual group discussion)							Survey 2 (after virtual group discussion)							
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8
CRET01	0.90	0.05	0.17	0.04	0.09	0.11	0.05	0.20	0.86	0.10	0.16	0.16	0.22	0.11	0.09
CRET02	0.93	0.02	0.18	0.09	0.09	0.03	0.05	0.21	0.89	0.16	0.17	0.15	0.21	0.07	0.07
CRET03	0.92	0.03	0.15	0.09	0.07	0.07	0.08	0.19	0.88	0.15	0.15	0.15	0.22	0.10	0.08
HELP01	0.20	0.13	0.15	0.73	0.10	0.04	−0.00	0.22	0.27	0.08	0.80	0.15	0.15	0.15	0.10
HELP02	−0.03	0.10	0.18	0.86	0.13	−0.03	−0.03	0.32	0.14	0.18	0.80	0.17	0.22	0.12	0.08
HELP03	0.04	0.09	0.19	0.88	0.09	0.01	−0.09	0.29	0.11	0.13	0.83	0.14	0.18	0.08	0.14
SOCB01	0.22	0.15	0.83	0.18	0.08	0.07	0.04	0.29	0.27	0.08	0.20	0.14	0.78	0.12	0.15
SOCB02	0.16	0.07	0.81	0.17	0.23	0.01	0.14	0.24	0.27	0.21	0.13	0.20	0.81	0.08	0.04
SOCB03	0.18	0.14	0.84	0.25	0.03	0.10	0.03	0.22	0.23	0.07	0.27	0.26	0.77	0.08	0.14
HONS01	0.11	0.04	0.12	−0.00	0.02	0.86	0.06	0.03	0.09	0.15	0.09	0.04	0.03	0.86	0.19
HONS02	0.09	−0.06	0.12	−0.14	0.05	0.85	0.09	0.07	0.13	−0.01	−0.00	0.01	0.09	0.89	0.15
HONS03	−0.01	−0.03	−0.10	0.17	0.18	0.66	0.18	0.10	0.01	0.26	0.21	0.09	0.09	0.72	−0.02
RECO01	−0.00	0.89	0.16	0.07	0.03	−0.02	0.06	0.19	0.12	0.06	0.11	0.80	0.17	0.16	0.06
RECO02	0.06	0.90	0.05	0.10	0.09	−0.03	0.01	0.23	0.19	0.15	0.12	0.82	0.14	−0.02	0.07
RECO03	0.03	0.87	0.09	0.14	0.08	−0.00	0.02	0.16	0.12	0.03	0.16	0.85	0.16	−0.01	0.21
COMP01	0.03	0.02	0.18	0.03	0.78	0.04	−0.02	0.14	0.06	0.80	0.07	−0.02	0.07	0.12	0.08
COMP02	0.10	0.10	0.11	0.16	0.89	0.06	−0.00	0.10	0.17	0.91	0.07	0.13	0.06	0.08	−0.02
COMP03	0.12	0.10	−0.01	0.12	0.79	0.13	−0.08	0.10	0.11	0.88	0.16	0.12	0.14	0.16	−0.02
SUBM01	0.03	0.01	0.04	−0.06	−0.12	0.13	0.88	0.00	0.10	−0.08	0.03	0.10	0.12	0.17	0.88
SUBM02	0.13	0.08	0.13	−0.05	0.02	0.18	0.84	0.12	0.08	0.14	0.24	0.20	0.09	0.13	0.81
SATF01								0.87	0.14	0.06	0.13	0.14	0.13	0.05	0.02
SATF02								0.90	0.13	0.10	0.21	0.17	0.14	0.06	0.02
SATF03								0.90	0.13	0.07	0.18	0.15	0.13	0.06	0.04
SATF04								0.81	0.13	0.13	0.14	0.09	0.07	0.01	0.08
SATF05								0.75	0.15	0.13	0.17	0.16	0.32	0.11	0.03
Eigenvalues	5.13	2.69	2.03	1.94	1.63	1.21	1.05	9.93	2.48	2.06	1.82	1.54	1.27	1.02	1.00
% Of variance	25.65	13.44	10.15	9.70	8.13	6.04	5.24	39.74	9.91	8.24	7.27	6.16	5.09	4.09	4.01
Cumulative %	25.65	39.09	49.24	58.94	67.07	73.11	78.35	39.74	49.64	57.88	65.15	71.31	76.39	80.48	84.49

Bold indicates factor loading used in interpretation of the factor structure.

4.2. Hypothesis testing

Multiple linear regression analysis was used to test the hypotheses. The variations in personalities (independent variables) were regressed together with several demographic variables as controls on satisfaction (the dependent variable). To assess the relative importance of variations in personality across the real and virtual worlds *versus* demographic variables, two additional models were run. Effect size (f^2) was calculated using the formula

$$\frac{(R^2_{\text{full}} - R^2_{\text{partial}})}{1 - R^2_{\text{full}}}$$

Multiplying f^2 by $(n - k - 1)$, where n is the sample size (89) and k is the number of independent variables, provides a pseudo F -test for the change in R^2 with 1 and $n - k$ degrees of freedom. Effect sizes of 0.02, 0.15 and 0.35 denoted small, medium, and large effects, respectively. The results in Table 7 show that demographic variables and variation in personality variables between the real and virtual worlds account for 3.4% ($f^2 = 0.05$) and 25.3% ($f^2 = 0.36$),

respectively, of the variations in satisfaction derived from the virtual group discussion. Based on this, a negative association between the independent variable and the dependent variable indicated that a smaller variation in the corresponding personality variation (real-world *versus* virtual-world) was associated with a greater degree of satisfaction derived from participating in the virtual-world group discussion, and *vice versa*. These results showed that smaller personality variations between the real and virtual worlds in the helpful, sociable, recognition-seeking, and submissive factors significantly resulted in higher degrees of satisfaction derived from the virtual group discussion. Hence, H2, H3, H5 and H7 were supported. Among the control variables, *years of study* had a significant negative effect on satisfaction with the virtual-world group discussion.

To further ensure the robustness of the results, we also tested for *common method variance*. Indeed, this was a potential threat to the internal validity of our research, particularly as it involved responses from a single setting. The threat of common method variance is high if a single factor can account for a majority of the covariances in the independent and dependent variables. An examination of the factor analysis results shows the absence of a

Table 5
Summary statistics of sample data.

Code	Variable	Mean			Std. dev.			Alpha		Correlations among constructs							
		Survey 1	Survey 2	Variation	Survey 1	Survey 2	Variation	Survey 1	Survey 2	CRET	HELP	SOCB	HONS	RECO	COMP	SUBM	SATF
CRET	Creativity	3.41	3.39	1.21	0.83	0.90	1.79	0.94	0.97	0.97							
HELP	Helpfulness	3.36	2.73	1.23	0.64	0.77	2.00	0.83	0.92	0.29	0.94						
SOCB	Sociability	3.28	3.18	0.88	0.76	0.78	1.70	0.88	0.92	0.37	0.35	0.96					
HONS	Honesty	2.61	2.72	0.87	0.73	0.78	1.45	0.82	0.74	0.20	0.30	0.29	0.95				
RECO	Recog. seeking	3.66	2.89	1.62	0.77	0.85	2.50	0.88	0.87	0.32	0.40	0.29	0.23	0.92			
COMP	Composure	3.07	3.21	1.02	0.77	0.82	1.61	0.79	0.89	0.26	0.16	0.15	0.15	0.23	0.90		
SUBM	Submissiveness	2.66	2.57	0.78	0.71	0.75	1.30	0.84	0.73	0.18	0.28	0.21	0.12	0.28	0.16	0.83	
SATF	Satisfaction	n.a.	4.07	n.a.	n.a.	1.21	n.a.	n.a.	0.95	−0.26	−0.40	−0.35	−0.24	−0.38	−0.16	−0.29	0.98

Diagonal elements in the correlations among constructs represent the square root of AVE of the respective construct.

Table 6
VIF values of variables.

Construct	VIF value
Creativity (LOG)	1.31
Helpfulness (LOG)	1.38
Sociability (LOG)	1.35
Honesty (LOG)	1.20
Seeking of recognition (LOG)	1.35
Composure (LOG)	1.14
Submissiveness (LOG)	1.16

single factor that explains a majority of the covariances. Furthermore, we checked to see whether any of the factors had an eigenvalue lower than 1.0 [19]. Again our factor analysis results showed that all had eigenvalues above 1.0. Hence, common method variance was unlikely to be a threat for our results.

5. Discussion and implications

Computer-mediated communication allows us to interpose an avatar in a virtual-world into group discussions; this additional level of disconnectedness seemed to have real-world implications. Our research sought to answer the question of whether consistency in personality between the virtual- and real-worlds would result in individuals experiencing greater satisfaction from group discussions. Our results suggested that individuals who perceived lower variations in personality when being helpful, sociable, submissive, and recognition-seeking reported higher degrees of satisfaction with their group discussion experience. However, variations in personality factors related to being creative, honest, and composed did not significantly influence satisfaction. It seems that, to achieve certain activities and goals, individuals have a greater tendency to organize, evaluate, and keep track of behavioral responses. Interestingly, variation in honesty across real- and virtual-worlds, which is also behavioral in nature, had no significant impact on satisfaction.

The control variable *years of study* was found to have a negative effect on the satisfaction derived from the virtual-world group discussion. According to the *status quos* bias theory, people tend to prefer to stay with their old way of doing things and thus a need to change could reduce their satisfaction with a method. In contrast, the junior students, with less exposure may be more open to or curious about new learning tools such as the virtual-world.

Table 7
Regression analysis.

	Full model	Theoretical model	Control model
Personality			
CRET	−0.03	−0.04	–
HELP	−0.20**	−0.20**	–
SOCB	−0.17**	−0.16**	–
HONS	−0.05	−0.06	–
RECO	−0.18**	−0.18**	–
COMP	−0.03	−0.03	–
SUBM	−0.13*	−0.13*	–
Control variables			
Faculty	−0.02	–	−0.02
Years of study	−0.16*	–	−0.12
Gender	0.01	–	−0.03
Ethnicity	0.05	–	0.06
Age	0.08	–	0.03
YCOM	−0.07	–	−0.16^
YINT	0.03	–	0.06
Adjusted R-square	0.29	0.25	0.03

^Significant at $p \leq 0.10$.

* Significant at $p \leq 0.05$.

** Significant at $p \leq 0.01$.

5.1. Limitations

Our research findings come with some caveats. First, the study was conducted in a technology-mediated group discussion context where the virtual-world technology was employed to supplement conventional group discussion activities that usually involved physical face-to-face interactions. Nonetheless, our study provided insights into the use of emerging technology to support conventional group discussion activities, which remain the dominant paradigm in organizations today.

Second, our study was conducted in a setting where most participants come from similar cultural backgrounds. However, previous research has shown that personality factors are stable across cultures [13], and that the ethnicity of respondents did not affect our results. Third, our research focused on measuring satisfaction, which is one aspect of various outcomes from group discussion. Nevertheless, our study was important in its own right, as there is a general carry-over effect that may influence individuals' willingness to participate in other virtual group discussion. Dissatisfied individuals are likely to either withdraw, refuse to participate in, or perform badly in subsequent virtual group discussions.

Fourth, this study was conducted within a university in Asia. Though the study did not detect a significant gender difference in the results, [4] found that gender differences were most marked among European and American cultures and attenuated among African and Asian cultures. Thus cultural differences could present a moderating effect on the influence of the gender differences.

Fifth, using student subjects may raise a concern of generalizability. We tried to alleviate this by carefully designing the virtual-world discussion sessions to be similar to those in an organizational setting. Towards this end, the setting of our study captured two key components: (1) the goal-oriented nature of the interactions and (2) the lack of anonymity.

5.2. Implications

Our research contributed knowledge in two ways. First, our study empirically assessed the use of the virtual world as a group discussion environment to complement conventional face-to-face group discussions. It achieved this by employing a perspective of variations in real *versus* virtual world personalities to investigate individuals' satisfaction from participating in such an environment. We also systematically identified a parsimonious set of personality factors that could be employed to assess personality differences in the virtual-world setting. This helped us make the administration of personality instruments easier and more relevant to our target context—respondents were not overwhelmed by a large personality inventory and the seven personality factors accounted for 25% of the variances in individuals' satisfaction with a virtual group discussion. Second, our study extended the investigation into the satisfaction construct that has been recognized as important for individual use of the virtual-world. Third, our study adopted a self-regulation theory to justify the hypotheses of variations in personality and satisfaction.

The results obtained from testing the hypotheses also provide some interesting insights on the different effects of behavioral-, cognitive- and emotional-based personalities on individuals' satisfaction with virtual group discussion experience. Smaller variations in behavioral personalities across the real and virtual worlds, as seen in the helpfulness and sociability factors, lead to greater satisfaction. In contrast to normal beliefs, our research indicated that assuming a more consistent personality in a virtual-world (relative to the real-world) lead to greater satisfaction with the outcome. With respect to these leads, the administrator or manager of virtual-world group discussions should make the goal-oriented nature of the sessions clear. Several familiarization

sessions should be conducted before an actual discussion to reduce the novelty effect that may arouse participants' curiosity and encourage disinhibition.

6. Conclusion

As one virtual-world participant said: *"We were all in a conference room that looked just like a room we would have gone into in real life. We even had coffee and fruit as well as a projection screen to show slides. . . . It gave all of us the feeling that we were really in the room together and that we were paying much better attention to the meeting. When we are only speaking on the phone, we all tend to multi-task, but this had a different feel, we all wanted to pay attention and be engaged."*

With the growing interest of organizations in employing virtual-world technologies to enhance group discussion experience, our study provided useful suggestions to organizations about how these technologies could be utilized to enhance employees' satisfaction with the meeting process, which, in turn, could help in maximizing their benefits.

Acknowledgements

We would like to thank Prof. Bernard C.Y. Tan for his comments on the earlier version of this paper, and the support provided by the Computer Centre team of National University of Singapore (NUS) in conducting this research.

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